

**UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF MASSACHUSETTS**

SINGULAR COMPUTING LLC,

Plaintiff,

v.

GOOGLE LLC,

Defendant.

Civil Action No. 1:19-cv-12551 FDS

Hon. F. Dennis Saylor IV

**JOINT PRE-TRIAL MEMORANDUM**

In advance of the final pre-trial conference scheduled for January 4, 2024, and pursuant to Local Rule 16.5(d), Plaintiff Singular Computing LLC (“Singular”) and Defendant Google LLC (“Google”) hereby submit this joint pre-trial memorandum.

## **I. SUMMARY OF EVIDENCE**

In this patent infringement case, Singular contends that two versions of Google’s Tensor Processing Units (“TPUs”)—devices that accelerate certain computing tasks used in machine learning—infringe claim 53 of U.S. Patent No. 8,407,273 (“the ’273 patent”) and claim 7 of U.S. Patent No. 9,218,156 (“the ’156 patent”). Singular further contends that Google’s infringement was willful. Google contends that Singular cannot meet its burden of proving that Google’s TPUs have infringed, or currently infringe, any of the asserted claims or that any such infringement was or is willful. Both sides will present evidence relating to these issues.

Google further contends that all of the asserted claims are invalid under 35 U.S.C. §§ 102 and/or 103 because those claims are anticipated and/or rendered obvious by prior art. Both sides will present evidence relating to these issues, as well.

Singular seeks damages in the form of a lump sum representing a reasonable royalty for Google’s alleged infringement based on Google’s deployment of TPUs, as well as enhanced damages under 35 U.S.C. § 284. To the extent any asserted claim is found to be infringed, and not invalid, Google agrees that a lump sum, reasonable royalty is the appropriate measure of damages. Google disputes, however, Singular’s assertions of what constitutes an appropriate, lump-sum reasonable royalty and the underlying methodology used by Singular to calculate that royalty. Google further disputes that Singular is entitled to enhanced damages and the time frame for which damages (if any) should apply. Both sides will also present evidence relating to these

issues, except that the issue of enhancement must be decided by the Court (if necessary) at a later date.

## **II. UNDISPUTED FACTS**

The following facts are not in dispute:

### **A. The Parties**

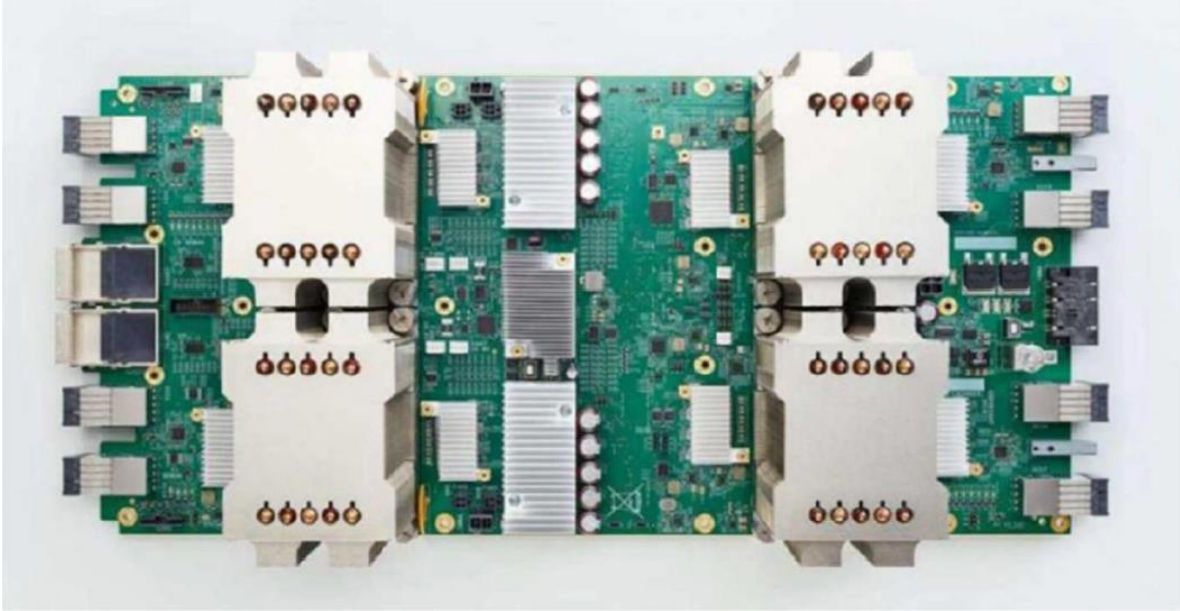
1. Singular is a Delaware limited liability company having its principal places of business at 10 Regent Street, Newton, MA 02465 and The Cambridge Innovation Center, 1 Broadway, Cambridge, Massachusetts 02142.
2. Google is a Delaware limited liability company with a principal place of business at 1600 Amphitheatre Parkway, Mountain View, California 94043.

### **B. Singular's Patents-in-Suit**

3. On December 20, 2019, Singular filed the Complaint asserting infringement of the '273 patent and the '156 patent.
4. In this action, Singular presently asserts claim 53 of the '273 patent and claim 7 of the '156 patent.
5. The asserted claims are both directed to an apparatus.

### **C. Google's TPUs**

6. The following image shows a TPUv2 board.



7. Each TPUv2 board comprises four integrated circuits known as Jellyfish Chips (“JFCs”) that are attached to the board.
8. Each JFC contains two Tensor Cores.
9. Each Tensor Core in a JFC has, among other things, one Vector Processing Unit (“VPU”), one Matrix Multiply Unit (“MXU”), and a Core Sequencer. Each JFC has a total of two MXUs and two VPUs.
10. Each TPUv2 board has a total of eight MXUs and eight VPUs.
11. Each TPUv3 board comprises four integrated circuits known as Dragonfish Chips (“DFCs”) that are attached to the board.
12. Each DFC contains two Tensor Cores.
13. Each Tensor Core in a DFC includes, among other things, one VPU, two MXUs, and a Core Sequencer.
14. Each DFC has a total of four MXUs and two VPUs.
15. Each TPUv3 board has a total of 16 MXUs and eight VPUs.

**D. A Person of Ordinary Skill in the Art**

16. The parties have characterized a person of ordinary skill in the art in the following two ways, but agree that there is no material difference between the two characterizations:

- **Singular**: a person of ordinary skill in the art that a person of ordinary skill in the art would have a Bachelor's degree in Computer Science, Electrical Engineering, or Applied Mathematics, with 2 years of academic or industry experience in computer architecture.
- **Google**: a person of ordinary skill in the art would have had at least a bachelor's degree in Electrical Engineering, Computer Engineering, Applied Mathematics, or the equivalent, and at least two years of academic or industry experience in computer architecture. More education could be considered as a substitute for experience, and vice versa.

**E. Damages**

17. The date of the hypothetical negotiation is March 1, 2017.

18. To the extent that Singular is entitled to damages, the amount of damages is equal to a reasonable royalty that:

- a. would take the form of a single, lump-sum payment; and
- b. would encompass a non-exclusive license from March 1, 2017 through the end of life of both patents-in-suit.

The parties are in the process of identifying whether there are additional facts that are not in dispute and will submit a supplemental stipulation with respect to any such facts, if appropriate.

### **III. CONTESTED ISSUES OF FACT**

The parties identify the following issues that remain to be litigated. The parties reserve the right to identify additional factual or legal issues that may arise, including issues raised by the Court's rulings on any pending motion, or a ruling made at the pretrial conferences in this action. By providing this statement, the parties do not concede that all of these issues are appropriate for trial or that they are purely factual questions. The parties do not waive any of their pending motions.

#### **A. Infringement**

1. Whether Google directly infringes claim 53 of the '273 patent.
2. Whether Google directly infringes claim 7 of the '156 patent.
3. Whether Google's infringement, if any, has been and continues to be willful.

#### **B. Damages**

4. What award of damages should be awarded to Singular to compensate for Google's direct infringement.

#### **C. Invalidity**

5. Whether claim 53 of the '273 patent is invalid as anticipated and/or obvious.
6. Whether claim 7 of the '156 patent is invalid as anticipated and/or obvious.

#### **Google's Additional Contested Issues of Fact:**

Google submits that the following additional issues remain to be litigated. Singular disagrees.

7. Whether Singular has carried its burden of pleading and proving that it complied with the marking requirement of 35 U.S.C. § 287(a).
8. Whether the underlying facts support a finding that claim 53 of the '273 patent is invalid as obvious given:
  - a. The scope and content of the prior art.
  - b. The differences, if any, between claim 53 of the '273 patent and the prior art.
  - c. Whether a skilled artisan would have had a motivation to combine pieces of prior art in the way recited in claim 53 of the '273 patent.
9. Whether the underlying facts support a finding that claim 7 of the '156 patent is invalid as obvious given:
  - a. The scope and content of the prior art.
  - b. The differences, if any, between claim 7 of the '156 patent and the prior art.
  - c. Whether a skilled artisan would have had a motivation to combine pieces of prior art in the way recited in claim 7 of the '156 patent.

#### **IV. JURISDICTION QUESTIONS**

None.

#### **V. QUESTIONS RAISED BY PENDING MOTIONS**

**A. Certain of Singular's motions *in limine*, filed December 5, 2023, are pending and present the following questions:**

1. Whether the Court should preclude Google from arguing invalidity based on the VFLOAT system, alone or in combination with other references.

2. Whether the Court should preclude Google from arguing or presenting evidence at trial that Singular's damages in this case are limited by the marking requirements of 35 U.S.C. § 287.

**B. One of Google's motions *in limine*, filed December 5, 2023, is pending and presents the following question:**

1. Whether the Court should preclude Singular from presenting evidence or argument regarding communications between Google employees and attorneys.

**VI. TRIAL STIPULATIONS**

- A.** For the purposes of the January trial, the numbers that either party will use as the number of TPU chips (JFCs and DFCs) in use "globally" from 2017-3Q2023 are the chip numbers provided in GOOG-SING-241418-419 and GOOG-SING-243995, as further described in Google's Sixth Supplemental Responses & Objections to Singular's Interrogatory No. 23 dated December 1, 2023.
- B.** For the purposes of the January trial, the numbers that either party will use as the number of TPU chips (JFCs and DFCs) placed into use in United States datacenters and datacenters outside the United States from 2017-3Q2023 are the chip counts provided in GOOG-SING-00243996 and GOOG-SING-00243997, as further described in Google's Sixth Supplemental Responses & Objections to Singular's Interrogatory No. 23 dated December 1, 2023.
- C.** For the purposes of the January trial, the parties agree that the fact of potential "overstate[ment]" of the chip numbers listed in Stipulation A above (as identified in Google's December 1, 2023 Sixth Supplemental Responses and Objections to Singular's Interrogatory No. 23) will not be used as a basis to undermine a party's



use of the “global” TPU chip use numbers listed in Stipulation A above. The parties further agree that the use of potential “overstate[ment]” does not apply to the chip numbers listed in Stipulation B above. This agreement does not preclude Google from challenging Singular’s use of global TPU chip numbers on any basis other than the “overstatement” issue.

## **VII. ISSUES OF LAW AND SUPPORTING AUTHORITY**

### **A. Obviousness**

Patents are presumed to be valid. 35 U.S.C. § 282. Google has the burden of proving obviousness by clear and convincing evidence. *See, e.g., Orexo AB v. Actavis Elizabeth LLC*, 903 F.3d 1265, 1271 (Fed. Cir. 2018). The parties dispute whether the asserted claims are invalid as obvious. A patent claim is invalid “if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” 35 U.S.C. § 103(a) (pre-AIA). Obviousness is a legal question based on underlying factual determinations. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). Among the factual determinations are “the scope and content of the prior art, differences between the prior art and the claims at issue, the level of ordinary skill in the pertinent art,” *Randall Mfg. v. Rea*, 733 F.3d 1355, 1362 (Fed. Cir. 2013), as well as “whether the relevant skilled artisan had a motivation to combine pieces of prior art in the way eventually claimed in the patent at issue,” *Intercontinental Great Brands LLC v. Kellogg N. Am. Co.*, 869 F.3d 1336, 1343 (Fed. Cir. 2017).

In assessing obviousness, a “court must ask whether the [claimed] improvement is more than the predictable use”—a “predictable variation”—“of prior art elements according to their

established functions,” considering whether more is involved than “the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement.” *KSR*, 550 U.S. at 417. “[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.” *Id.* at 417. The court should consider a range of real-world facts to determine “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *Id.* at 418. “One of the ways in which a patent’s subject matter can be proved obvious is by noting that there existed at the time of invention a known problem for which there was an obvious solution encompassed by the patent’s claims.” *Id.* at 419–20.

The jury must also consider the secondary considerations of non-obviousness. *Apple Inc. v. Samsung Elecs. Co. Ltd.*, 839 F.3d 1034, 1052 (Fed. Cir. 2016) (citation omitted).

“[E]vidence of secondary considerations may often be the most probative and cogent evidence in the record. It may often establish that an invention appearing to have been obvious in light of the prior art was not.” *Id.* (citation omitted). Such evidence includes: copying by others, the existence of a long-felt need for the inventions, praise for the invention and commercial success. *Id.*

**B. Whether the “VFLOAT System” Qualifies as Prior Art Under 35 U.S.C. §102**

**Singular:** Whether a reference qualifies as prior art under § 102 is a question of law. *See In re Klopfenstein*, 380 F. 3d 1345, 1347-8 (Fed. Cir. 2004); *see also In re Hall*, 781 F.2d 897, 899 (Fed. Cir. 1986) (“The § 102 publication bar is a legal determination based on underlying issues of fact.”). Invalidity based on 35 U.S.C. § 102 requires “knowledge or use which is accessible to the public.” *See BASF Corp. v. SNF Holding Co.*, 955 F.3d 958, 963-964 (Fed. Cir.

2020) (emphasis added). As the court in *BASF* explained, “[p]rior knowledge or use that is not accessible to the public upon reasonable inquiry, confers no benefit on the public, and thus does not suffice as a defense under § 102(a).” *See BASF* 955 F.3d at 965 (internal citations omitted). The defendant bears the burden of establishing, by clear and convincing evidence, that prior knowledge or use of a system satisfies these requirements. *See Microsoft Corp. v. i4i Ltd. P’ship*, 131 S. Ct. 2238, 2239 (2011).

**Google:** Singular has not cited, and Google has not found, any Federal Circuit authority holding that it is a question of law whether prior art was “known or used by others” within the meaning of Section 102(a). The two cases Singular cites—*In re Klopfenstein*, 380 F. 3d 1345 (Fed. Cir. 2004), and *In re Hall*, 781 F.2d 897 (Fed. Cir. 1986)—exclusively address the determination of whether paper prior art qualifies as a “printed publication.” Therefore, Google believes it is appropriate for the jury to make this determination.

#### **VIII. REQUESTED AMENDMENTS TO THE PLEADINGS**

None.

#### **IX. ADDITIONAL MATTERS TO AID THE DISPOSITION OF THE ACTION**

None.

#### **X. PROBABLE LENGTH OF TRIAL**

**Singular:** Singular estimates that this action, after jury selection, can be conducted in approximately 12 days of trial from 9 AM to 1 PM. Singular submits that the trial could be further streamlined if Google agreed to stipulate to facts that it had previously represented to the Court were undisputed.

**Google:** Google estimates that this action, after jury selection, can be conducted in approximately 10 days of trial from 9 AM to 1 PM, though it submits that this estimate may require revision if Singular is permitted to play all deposition testimony presently designated.

## **XI. WITNESSES**

### **A. Singular's Witnesses**

Singular expects to call the following witnesses live at trial:

1. Joseph Bates
2. Sunil P. Khatri (expert witness)
3. Philip J. Isaak (expert witness)
4. Philip Green (expert witness)

Singular expects to present the testimony of the following witnesses by deposition designation:

1. Jeffrey Dean
2. Norman Jouppi
3. Andrew Phelps
4. James Loudan
5. David Patterson
6. Naveen Kumar
7. Matthew Mabey
8. Astro Teller
9. Andrew Ng
10. Nishant Patil
11. Kamran Shafiei
12. Tammo Spalink

13. Obi Felten
14. Catherine Tornabene
15. Andrew Swing

**B. Google's Witnesses**

Google expects to call the following witnesses live at trial:

1. Joseph Bates
2. Jeff Dean
3. John Gustafson (expert witness)
4. Norm Jouppi
5. Naveen Kumar
6. James Laudon
7. Miriam Leeser (fact and expert witness)
8. Matthew Mabey
9. James Maccoun
10. KC Mares (expert witness)
11. David Patterson
12. Laura Stamm (expert witness)
13. Marty Walker (expert witness)

Google expects to present the testimony of the following witnesses by deposition designation:

1. Joseph Bates
2. Stephen Boyd
3. Obi Felten
4. Michael Holzrichter

5. Mustafa Ozgen

6. Andrew Phelps

**C. Procedure for Witnesses**

The parties agree that fact witnesses will be sequestered, except that a party's designated trial representative need not be sequestered even if a fact witness. In other words, such witnesses will not watch any testimony or part of the trial before they testify and will not discuss the case or their testimony with any person once their cross examination begins until the cross examination ends. The parties agree that expert witnesses need not be sequestered.

No party shall be obligated to present testimony from any witness on its list of witnesses. The listing of a witness by a party on its witness list does not waive any objections to that witness should the opposing party attempt to call that witness to testify, either live or by deposition.

The parties will identify by email to the opposing party the witnesses they intend to call, in the order in which they intend to call them, and whether those witnesses will be called live or by deposition, by **5:00 p.m.** two (2) calendar days before the day on which such witness will be called to testify (*e.g.*, Sunday evening for a witness to be called on Tuesday). This paragraph applies only to the identification of witnesses. Witnesses whose testimony will be presented via deposition must also be disclosed according to the schedule set forth in the following section.

No later than **3:00 p.m.** one (1) day before it expects to conclude its case in chief (setting aside Google witnesses that Singular has deferred examining until Google proceeds with its case in chief), Singular will provide written notice to Google that it expects to conclude its case in chief so that Google will have adequate notice that it must be prepared to proceed with its case in chief.

**Google Proposal:** To avoid the need for non-expert witnesses to be recalled to the stand, the cross- or redirect-examination of non-expert witnesses called during a party's case-in-chief shall not be limited to the scope of direct examination if that party also identified that witness on their witness list.

**Singular disagrees** with this proposal. The Federal Rules of Evidence, Federal Rules of Civil Procedure and the Judge's discretion should control.

## **XII. PROPOSED DEPOSITION DESIGNATIONS**

The parties propose the following competing procedures for identifying and objecting to deposition designations.

- **Singular's Proposal:** For any witnesses whose testimony the parties intend to present at trial by deposition, the parties shall identify a final list of deposition designations to be played or read to the jury, whether the testimony will be played by video or read, and the proposed exhibits used in the designations, by **2:00 p.m.** two (2) calendar days before designations to be played or read. Final objections to the testimony and/or exhibits and final counter-designations with proposed exhibits shall be provided by **4:00 p.m.** two (2) calendar days before designations are to be played or read. The parties shall meet and confer at **6:00 p.m.** the same day. By **8:00 p.m.** the same day, the parties shall exchange, in writing, brief explanations (i.e., one sentence each) describing the basis for each objection that they intend to maintain to any designations, counter-designations, and/or proposed exhibits, in order to facilitate the submission described below. If there are objections that remain to be resolved, the party calling the witness by deposition shall, no later than two (2) calendar days before the witness is to be called at trial, submit, on behalf of all parties: (i) a copy of the entire deposition testimony of the witness at issue,

clearly highlighting the designations, counter-designations, and pending objections; and  
(ii) a cover letter clearly identifying the pending objections as well as a brief indication  
(i.e., no more than one sentence per objection) of the basis for the objection and the  
offering party's response to it.

- **Google's Proposal:** For any witnesses whose testimony the parties intend to present at trial by deposition, the parties shall identify a final list of deposition designations to be played or read to the jury, whether the testimony will be played by video or read, and the proposed exhibits used in the designations, by **2:00 p.m.** three (3) calendar days before designations to be played or read. Final objections to the testimony and/or exhibits and final counter-designations with proposed exhibits shall be provided by **7:00 p.m.** three (3) calendar days before designations are to be played or read. The parties shall meet and confer at **8:30 p.m.** the same day. By **10:30 p.m.** the same day, the parties shall exchange, in writing, brief explanations (i.e., one sentence each) describing the basis for each objection that they intend to maintain to any designations, counter-designations, and/or proposed exhibits, in order to facilitate the submission described below. If there are objections that remain to be resolved, the party calling the witness by deposition shall, no later than two (2) calendar days before the witness is to be called at trial, submit, on behalf of all parties: (i) a copy of the entire deposition testimony of the witness at issue, clearly highlighting the designations, counter-designations, and pending objections; and (ii) a cover letter clearly identifying the pending objections as well as a brief indication (i.e., no more than one sentence per objection) of the basis for the objection and the offering party's response to it.



The party introducing the deposition testimony shall be responsible for editing the deposition video to include the testimony and any counter-designation testimony played in the same order it appears in the full transcript, minus any attorney objections, and shall provide a final version of the video and clip report with time allocations to all parties by **5:00 p.m.** the day before it is to be shown to the jury or state in writing that the deposition testimony will instead be read into the record.

Colloquy between counsel and objections will be eliminated when the deposition is read or played at trial.

When the witness is called to testify by deposition at trial, the party calling the witness shall provide the Court with two (2) copies of the transcript of the designations and counter-designations that will be read or played. An additional copy shall be provided to the court reporter.

If a party decides to play less than all of the designated testimony for a witness at trial, or to include less than all of its counter-designations, the opposing party may use such dropped testimony as counter-designations to the extent the usage of such testimony in such manner is otherwise consistent with Fed. R. Evid. 106, Fed. R. Civ. P. 32, and any other applicable Federal Rule of Evidence or Federal Rule of Civil Procedure.

### **XIII. PROPOSED EXHIBITS**

The parties' joint exhibit list and objections thereto are attached as **Exhibit A**. Singular's exhibit list and Google's objections thereto are attached as **Exhibit B**. Google's exhibit list and Singular's objections thereto are attached as **Exhibit C**. In submitting these exhibit lists, the parties do not waive any objection to the admissibility of any of the exhibits included in the lists.

The parties propose the following competing procedures for identifying and objecting to trial exhibits.

- **Singular's Proposal:** No later than **2:00 p.m.** the calendar day before their introduction, counsel shall (1) provide opposing counsel with an identification of trial exhibits and/or demonstratives to be used on direct examination of each witness (both live and by deposition), (2) make any non-documentary trial exhibits/demonstratives to be used with the witness available for physical inspection, and (3), for exhibits, state whether the exhibit will be sponsored by each witness. Any objections to the identified exhibits/demonstratives shall be provided no later than **4:00 p.m.** one (1) calendar day before the exhibits are proposed to be introduced and the parties shall meet and confer telephonically or in person in an attempt to resolve any objections to the exhibits/demonstratives at **6:00 p.m.** the day the objections are provided. The parties will continue in good faith to meet and confer regarding exhibits/demonstratives and if objections remain unresolved, the parties will cooperate in seeking to have the Court resolve any disputes prior to the introduction of the exhibit/demonstrative.
- **Google's Proposal:** No later than **5:00 p.m.** two (2) calendar days before their introduction, counsel shall (1) provide opposing counsel with an identification of trial exhibits and/or demonstratives to be used on direct examination of each witness (both live and by deposition), (2) make any non-documentary trial exhibits/demonstratives to be used with the witness available for physical inspection, and (3), for exhibits, state whether the exhibit will be sponsored by each witness. Any objections to the identified exhibits/demonstratives shall be provided no later than **5:00 p.m.** one (1) calendar day before the exhibits are proposed to be introduced and the parties shall meet and confer

telephonically or in person in an attempt to resolve any objections to the exhibits/demonstratives at **6:00 p.m.** the day the objections are provided. The parties will continue in good faith to meet and confer regarding exhibits/demonstratives and if objections remain unresolved, the parties will cooperate in seeking to have the Court resolve any disputes prior to the introduction of the exhibit/demonstrative.

The exhibit lists do not include potential impeachment material that is not introduced into evidence. Exhibits or other prior statements used solely for impeachment pursuant to FRE 613 need not be disclosed in advance. With respect to trial exhibits to be used on cross examination (not merely for impeachment), counsel shall provide opposing counsel with an identification of trial exhibits to be used on the cross examination of each witness at the beginning of the examination, unless counsel plans to introduce exhibits into evidence during the cross examination. In that case, the procedures described in the preceding paragraph would apply to such exhibits.

The parties shall exchange demonstratives (e.g., PowerPoint slides and magnetic boards) to be used in opening statements by **3:00 p.m.** the calendar day before opening statements. Any objections shall be provided no later than **5:00 p.m.** the calendar day before their intended use. The parties are to meet and confer to resolve any objections to the demonstratives for opening statements at **6:00 p.m.** the calendar day before opening statements.

The parties agree that exhibits that are documents and were both produced by a party and created by a party (e.g., emails sent with Singular or Google domains, presentations created by Singular or Google employees, spreadsheets reflecting Singular's or Google's finances, etc.) are authentic under FRE 901 and that the documents themselves are business records under FRE 803(6). This agreement is without prejudice to the parties' objections to these exhibits on other

grounds, including but not limited to that the document itself contains hearsay (i.e. hearsay within hearsay) or that the witness being asked to testify lacks personal knowledge.

The parties agree that any description of a document on an exhibit list is provided for convenience only and shall not be used as an admission or otherwise as evidence regarding the listed document or any other listed document.

Finally, legible copies of United States and foreign patents, the file prosecution histories of United States patents, published foreign patent applications may be offered and received in evidence in lieu of certified copies thereof, subject to all other objections which might be made to the admissibility of certified copies.

Google does not stipulate that Dr. Bates' notes qualify as business records under FRE 803(6).

Google submits that documents admitted as exhibits should each have a sponsoring witness. Singular disagrees and submits that admissible documents are evidence, just like testimony and they do not require sponsorship.

December 29, 2023

Respectfully submitted,

*/s/ Kevin Gannon*

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Counsel for Defendant Google LLC

**CERTIFICATE OF SERVICE**

I hereby certify that all counsel of record who have consented to electronic service are being served with a copy of this document via the Court's CM/ECF system.

/s/ Kevin Gannon